# Digital Platform Interoperability

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Technische Universität Wien, TUW

**June, 2024**

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# Learning outcomes

- *Understand and apply the term and concepts of platform interoperability*
- *Analyze selected examples of platform interoperability*
- *Determine the requirement for platform interoperability on different layers*

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# Digital platform interoperability – what?

- Digital platform interoperability refers to the ability of different digital platforms (e.g. social media, videoconferencing, e-commerce, banking…) to communicate and share data with one another.

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# Digital platform interoperability – why?

- Digital platform interoperability allows their users to access the functionality (services) of one platform from another, or share data across different systems without needing to manually transfer or copy the data.
- Interoperability also enables different platforms to work together to create new functionality and value for users.

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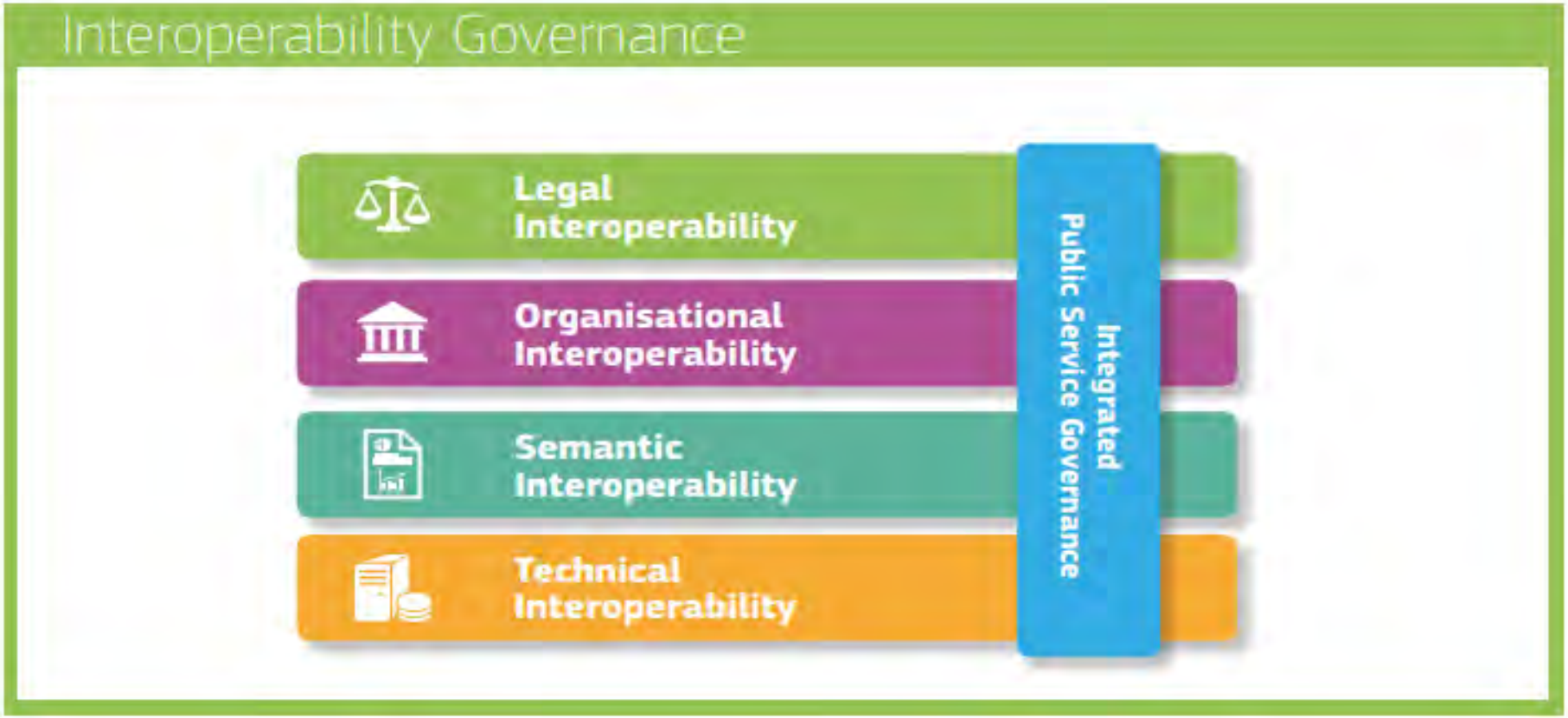
# European Interoperability Framework (EIF)

https://ec.europa.eu/isa2/sites/default/files/eif_brochure_final.pdf

- A set of principles, guidelines and recommendations to help organizations design and implement interoperable digital services and systems within the EU.

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# European Interoperability Framework (EIF) - Technical interoperability

- Technical interoperability is the ability of different systems to communicate and share data using common protocols and standards. Technical interoperability deals with technical issues related to the connection of computer systems, open interfaces, connection services, protocols, middleware, security in data exchange, etc.


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# European Interoperability Framework (EIF) - Semantic interoperability

- Semantic interoperability is the ability of different systems to understand the meaning of the shared data.
- In the EIF, semantic interoperability covers both semantic and syntactic aspects:
  - syntactic aspect deals with the format of data and messages,
  - semantic aspect refers to the meaning of data elements and the relationship between them.


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# European Interoperability Framework (EIF)

- Organizational interoperability refers to the way in which stakeholders align their business processes, responsibilities and expectations to achieve commonly agreed and mutually beneficial goals:
  - documenting and integrating or aligning business processes and relevant information exchanged
  - making services available, easily identifiable, accessible and user-focused


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# European Interoperability Framework (EIF)

- Legal interoperability implies adequate harmonization of regulations in different countries, so that electronic data originating from any member state have appropriate legal weight and recognition, wherever they have to be used in another country.


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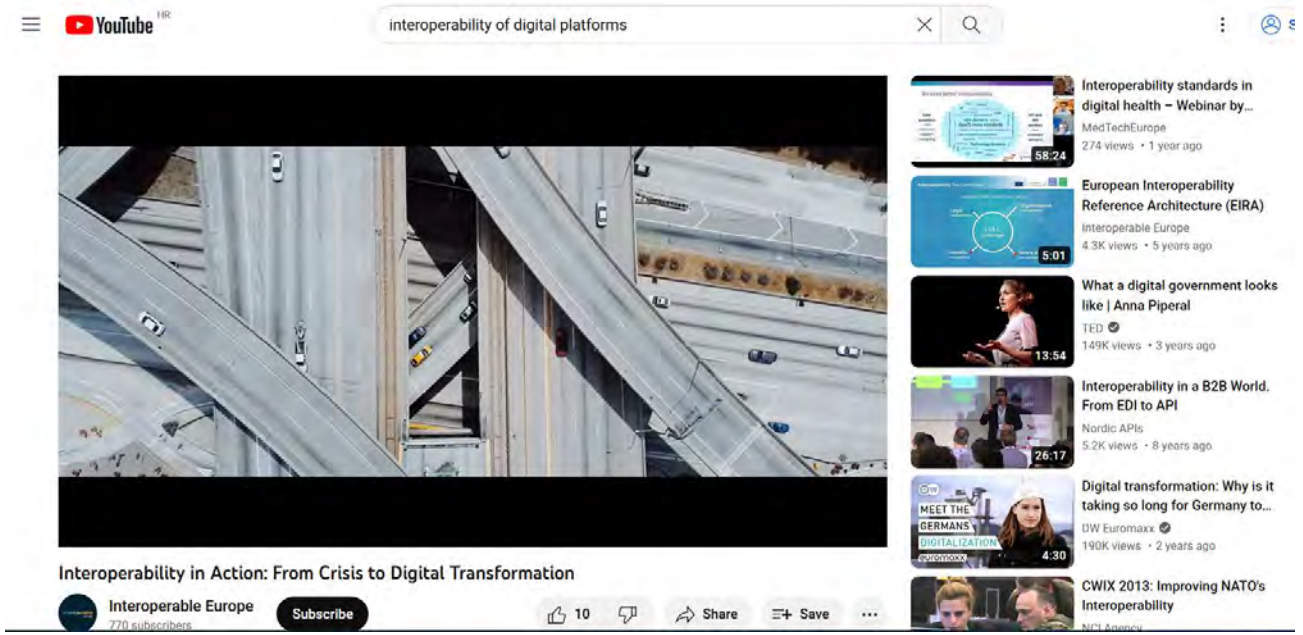
# Interoperability of digital platforms – Sources

- Books, on-line courses and videos
- Research papers and journals
- Industry reports and whitepapers
- Standards
- Online communities and forums
- Conferences and workshops
- Blogs and websites
- Government websites and publications
- Chatbots based on AI

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# Interoperability of digital platforms – Literature

- European Interoperability Framework,EIF), https://ec.europa.eu/isa2/sites/default/files/eif_brochure_final.pdf
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- Discussion on how data portability and interoperability measures can improve competition both within and among digital platforms - https://www.oecd.org/daf/competition/data-portability-interoperability-and-digital-platform-competition-2021.pdf
- Example for legal issues of interoperability - Duan, C. (2021). A Tale of Two Interoperabilities; or, How Google v. Oracle Could Become Social Media Legislation. *Cardozo L. Rev. De-Novo*, 246., https://larc.cardozo.yu.edu/cgi/viewcontent.cgi?article=1083&context=de-novo
- Publications related to the Digital Platform Interoperability standard being developed by The Open Group - http://www.opengroup.org/openplatform3.0/docs/
- An example of achieving interoperability in ELIXIR, an intergovernmental organization that brings together life science resources from across Europe - https://elixir-europe.org/platforms/interoperability

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# *Questions and assignments for students*

*Q1: Find an example where two platforms work together, complement their functionalities and exchange data.*

*Q2: For this example, specify what conditions must be met for them to be interoperable, on a technical, semantic, organizational and legal level.*

*Q3: What are the challenges and how are they solved?*

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# *Questions and assignments for students*

*Q4: Give an example of the communication platforms you use. Describe who initiates this communication and how it works. Are there any problems in that communication? Is there any need for your intervention during this communication, or some information?*

*Q5: Is there any communication between platforms that you find particularly useful?*

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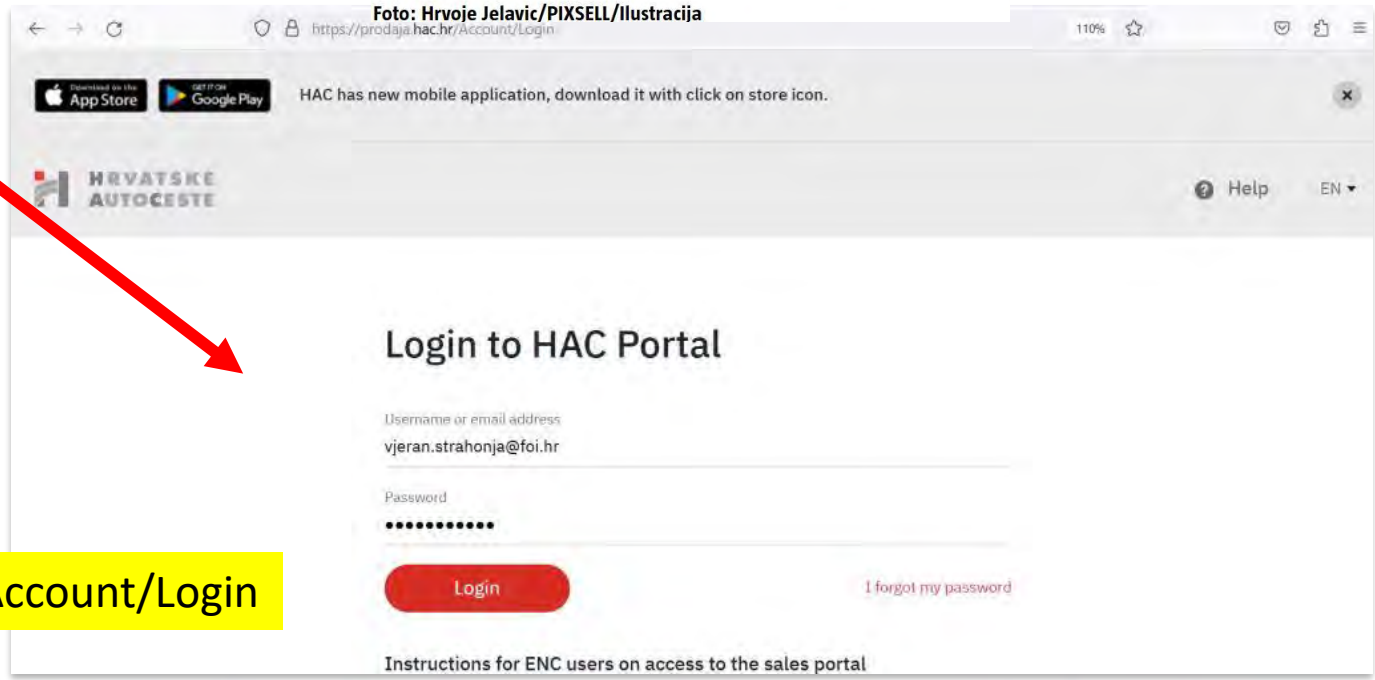
# Example of interoperability of platforms:
## Payment of electronic toll collection on the highway

- Context: In Croatia, contactless toll collection is used on highways with the help of ENC devices on the windshield.
- ENC is based on a prepaid method. The owner of the ENC device logs into the user portal and pays a certain amount to his ENC device. Various payment methods are supported.

Foto: Hrvoje Jelavic/PIXSELL/Ilustracija




*Task:*

- *Q6: Identify the platforms that are used for payment to the ENC account, the data that is exchanged*
- *Q7: How interoperability is achieved at the data, process and legal level?*

https://prodaja.hac.hr/Account/Login

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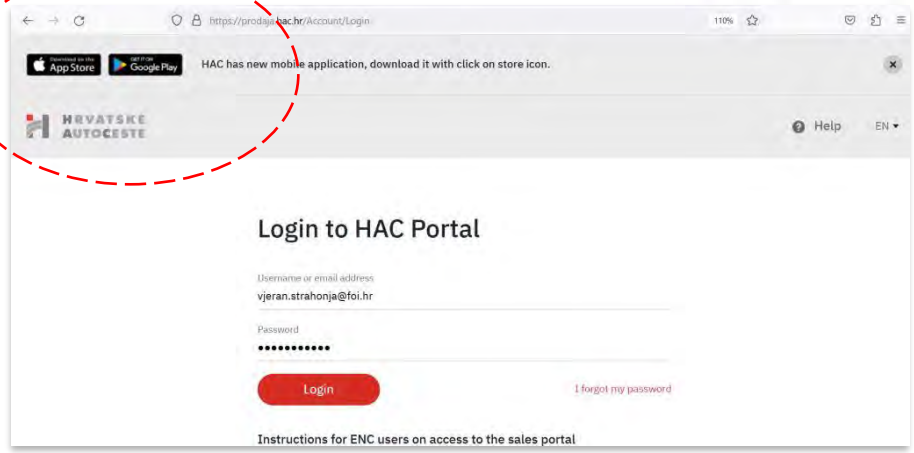
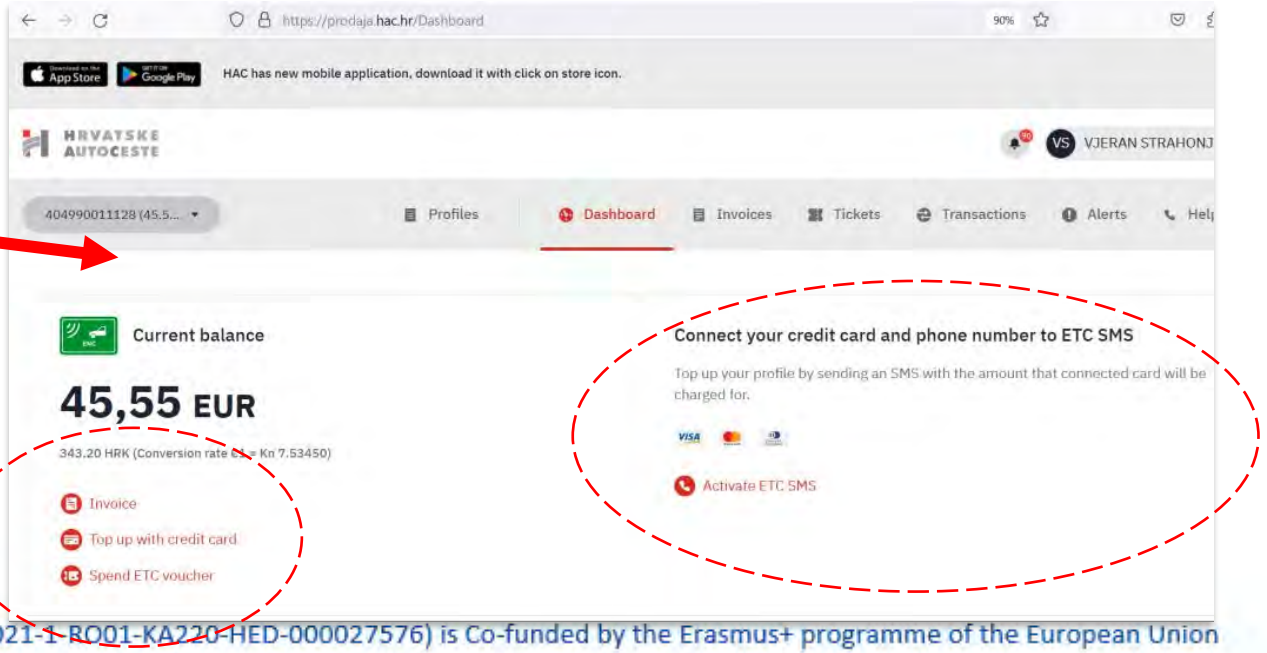
# Example of interoperability of platforms: Payment of electronic toll collection on the highway

1. *Croatian Highways (HAC) portal – Login*




1. *Payment form*

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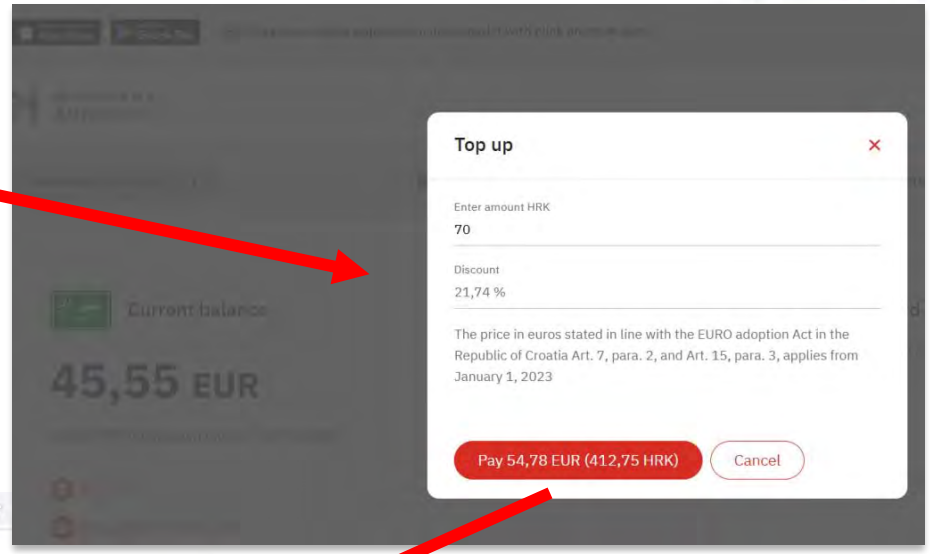
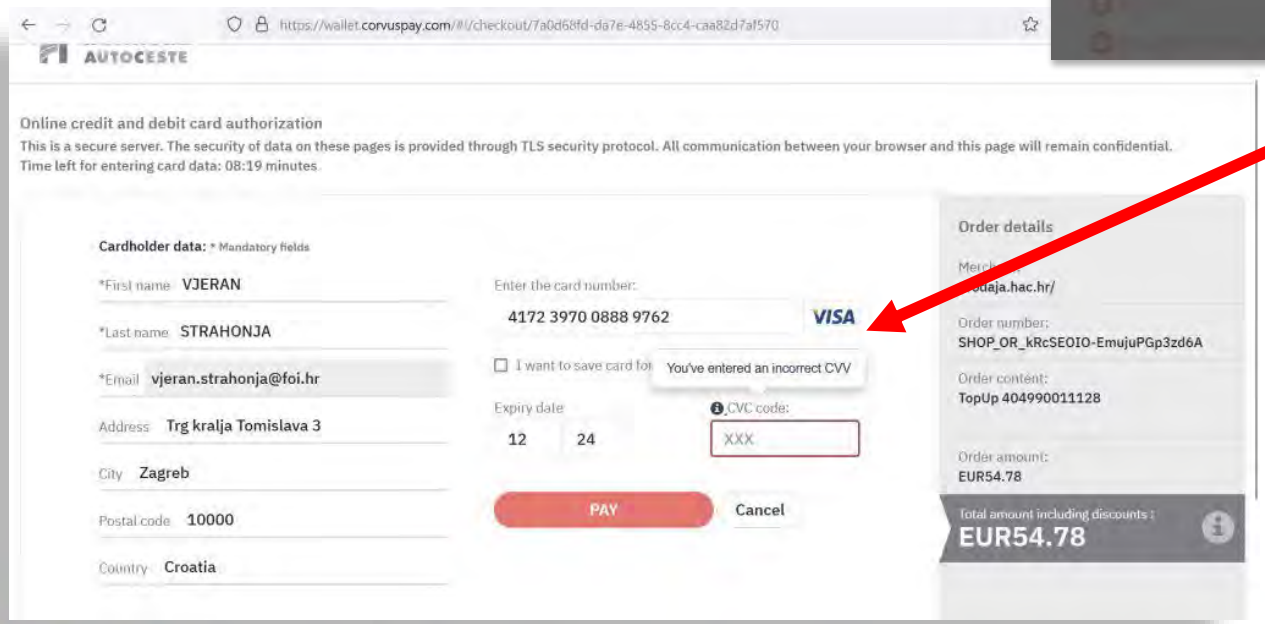
# Example of interoperability of platforms: Payment of electronic toll collection on the highway

*3. Pay by card*

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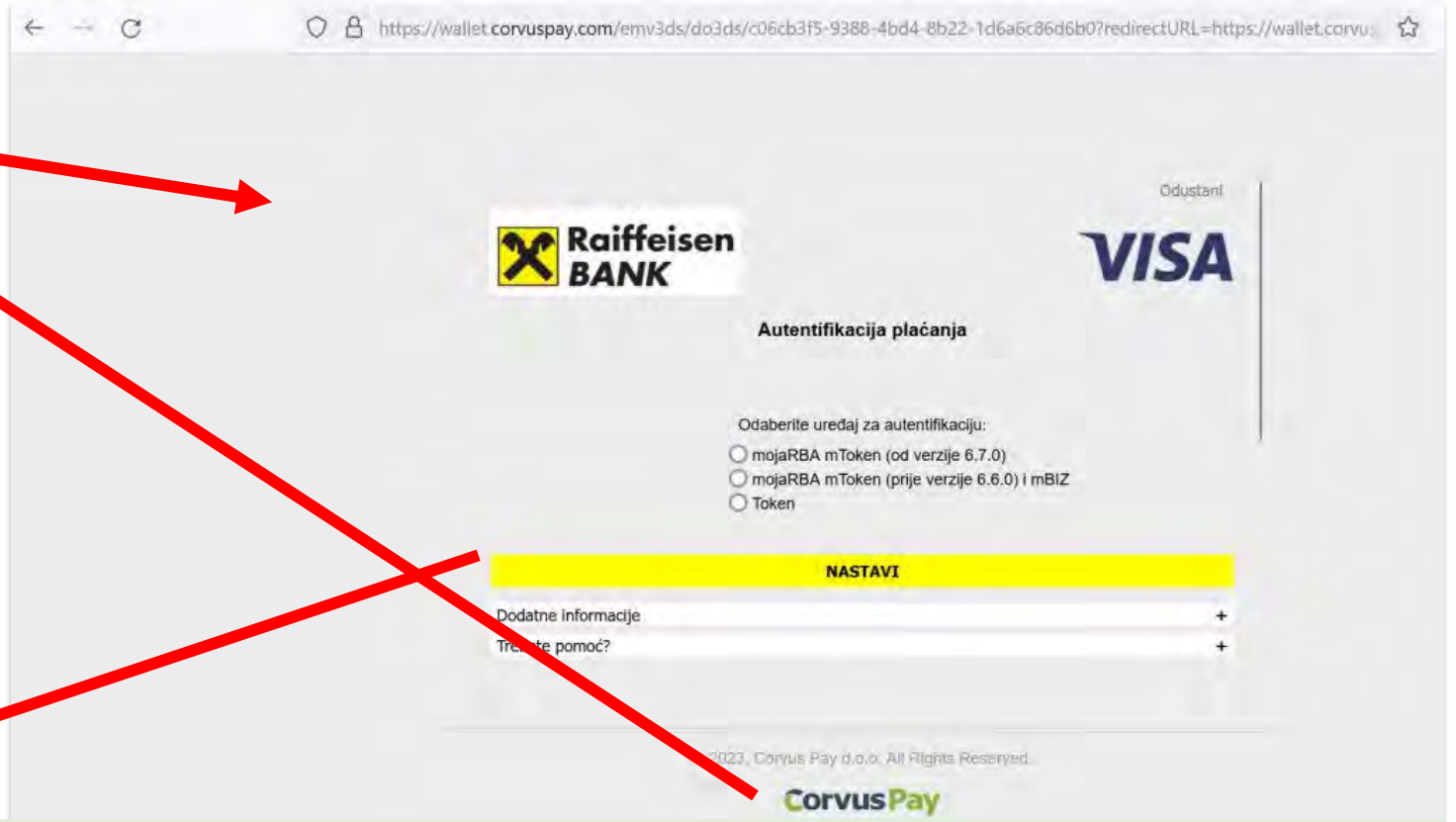
# Example of interoperability of platforms: Payment of electronic toll collection on the highway

## *3. Payment authentification*

CorvusPay - Internet Payment Gateway service for card payments in web shops.






A payment service provider (PSP) refers to **a third-party company that provides payment services to businesses that accept online payment methods**. These methods may include credit cards, debit cards, e-wallets, cash cards, bank transfers, and much more. Examples of PSPs include Amazon Pay, PayPal, Stripe, and Square.

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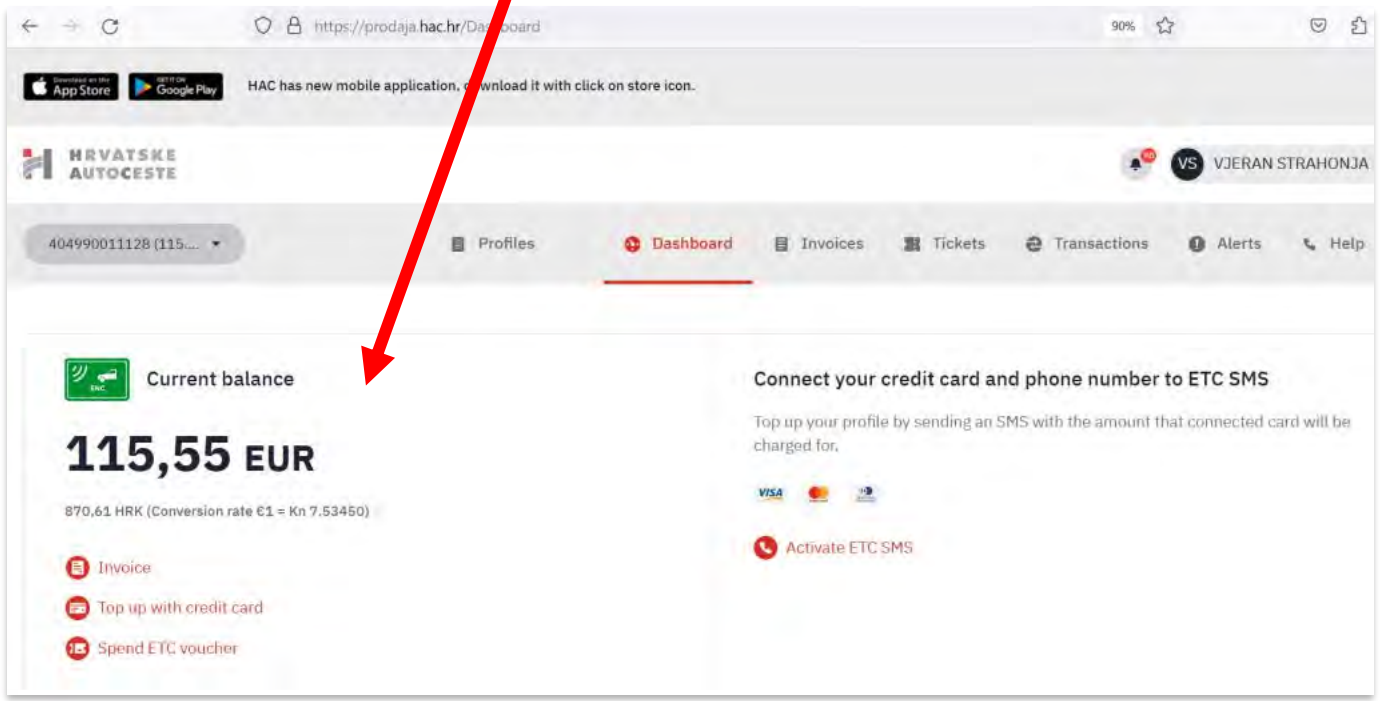
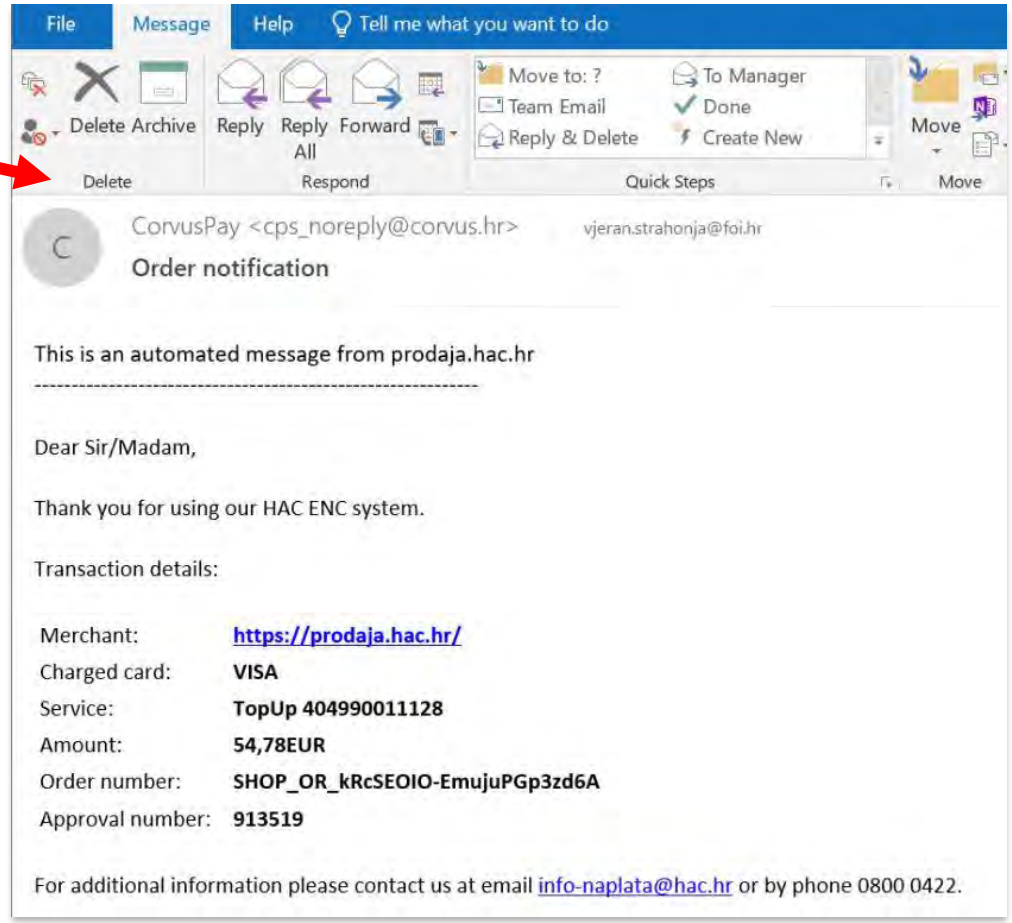
# Example of interoperability of platforms: Payment of electronic toll collection on the highway

## *4. Finalizing the transaction*

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# Technical Interoperability

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# Issues of lack of interoperability

- **Where** are you?

Communication deadlock

- **What** did you say?

Communication mismatch


- **Why** did you do that?

Unexpected behaviors


Source: https://www.etsi.org/images/files/ETSIWhitePapers/IOP%20whitepaper%20Edition%203%20final.pdf

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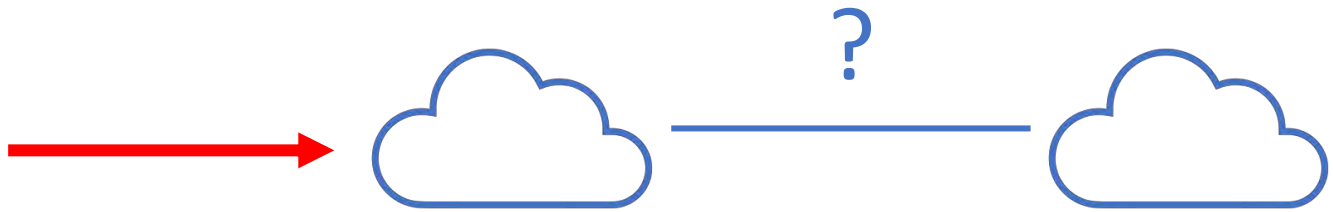


- **Why** did you do that?

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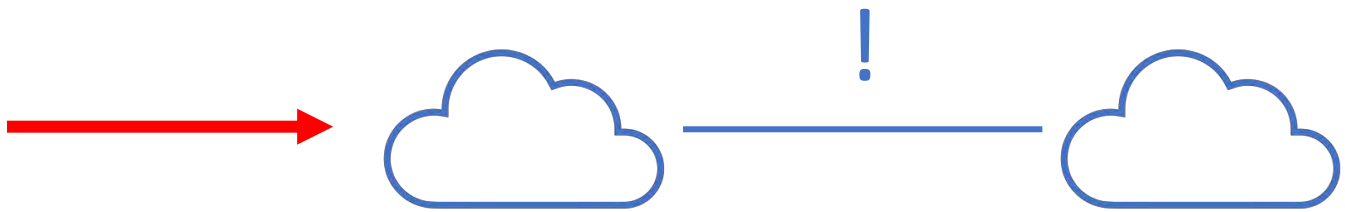


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# *Questions and assignments for students*

Q6: What are the possible causes of a smartphone that’s not recognised by the handsfree option in a car ('where are you?’ scenario)?

Q7: In which order will you diagnose the problem when something like this happens?

Q8: How will you eliminate certain causes?

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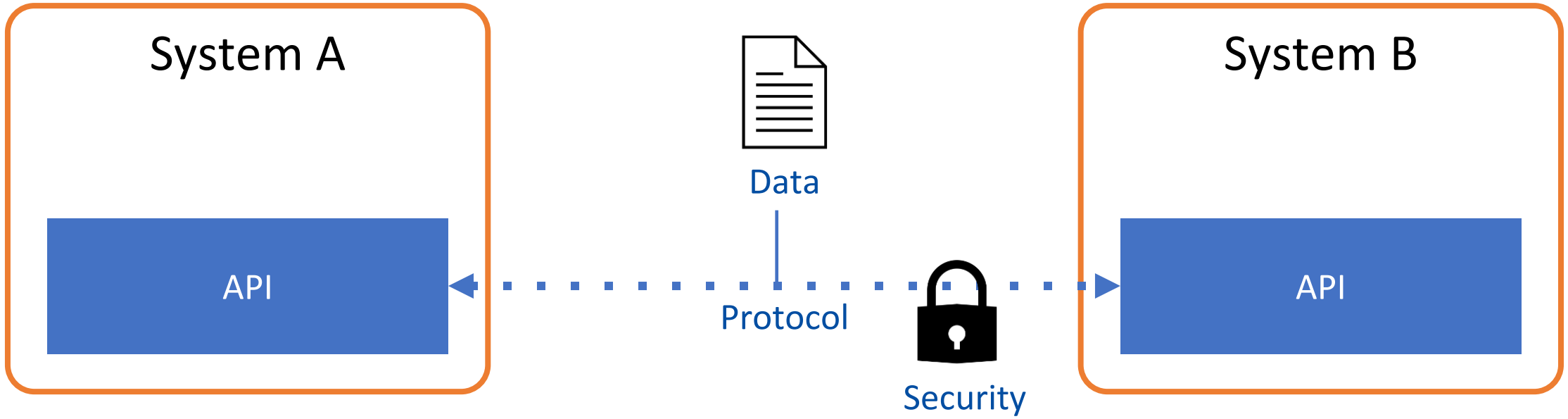
# Technical Components

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# Data format

- Define the data structure which is transmitted between communicating systems
- Standardized data formats
- Different formats vary in
  - Syntax complexity
  - Data size
  - Human readability
- e.g.: XML, JSON, CSV, YAML

```json
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 27,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [
    "Catherine",
    "Thomas",
    "Trevor"
  ],
  "spouse": null
}
```

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# Protocol

- A protocols is like a common language between system to communicate
- A protocol contain a set of procedures and objects which define the communication between different applications and platforms
- Most common protocols include REST, SOAP, JSON-RPC, GraphQL
- They strictly define what messages are allowed and how the messages are structured
- E.g.: REST protocol structure:
  - **HTTP method** – outlines the intended process (POST, GET, PUT or DELETE)
  - **Endpoint** – uniform resource identifier (URI) to locate the resource on the internet, mostly URLs
  - **Header** – stores data related to client and server, such as authentication measures
  - **Body** – contains additional information for the server, such as the data to be added

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# Programming interface (API)

- APIs provide a standardized input and output point of communication
- Promote interoperability and make it easier to develop complex software systems that interact with other systems
- Most common APIs: RESTful APIs, SOAP APIs, or GraphQL APIs
- In order to achieve interoperability, it is necessary for platforms to agree on a common set of APIs that can be used for accessing data and services across different platforms
- Example: Vienna real time Open Data on public transport

  Request information on the metro stop near the TU Wien:
  https://www.wienerlinien.at/ogd_realtime/monitor?stopId=4107

**A1:** Find an example for a Open Data API from your city or country, describe and provide the request and what output you get.

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# Security

- Todays applications have numerous API endpoints and different protocols which change over time making it challenging to have rigid security measures
- Compromised, exposed, or hacked API can expose personal data, financial information, or other sensitive data
- Different platforms may have different security requirements:
  - Authentication
  - Encryption
  - Access control
- Threats to communication and interfaces
  - Exposure of sensitive data
  - Compromise of data and functionalities
  - Denial of Service (DoS)

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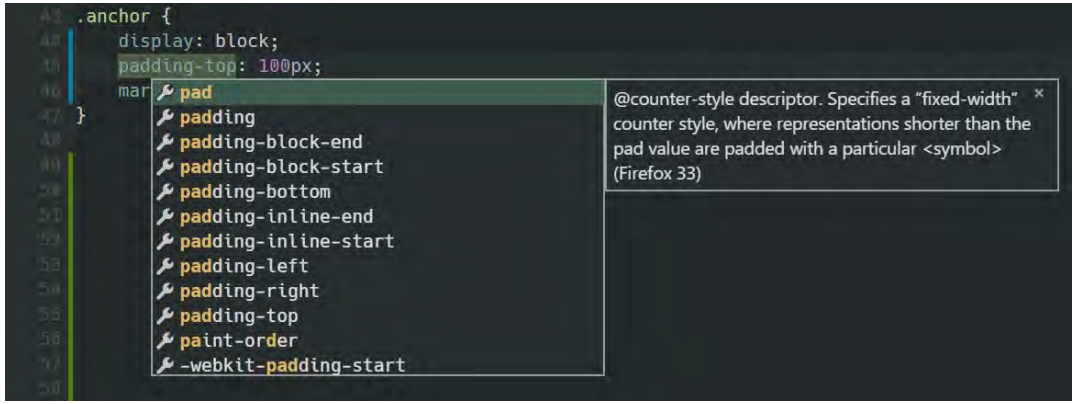
# Example – Language Server Protocol

DEMO

- LSP adds features like auto complete, go to definition, or documentation on hover to development tools
- Allows to use single language server for multiple development tools
- Open support for multitude of programming languages (https://langserver.org/)




CSS code complete in VS Code powered by the CSS LSP Server

Source: https://microsoft.github.io/language-server-protocol/

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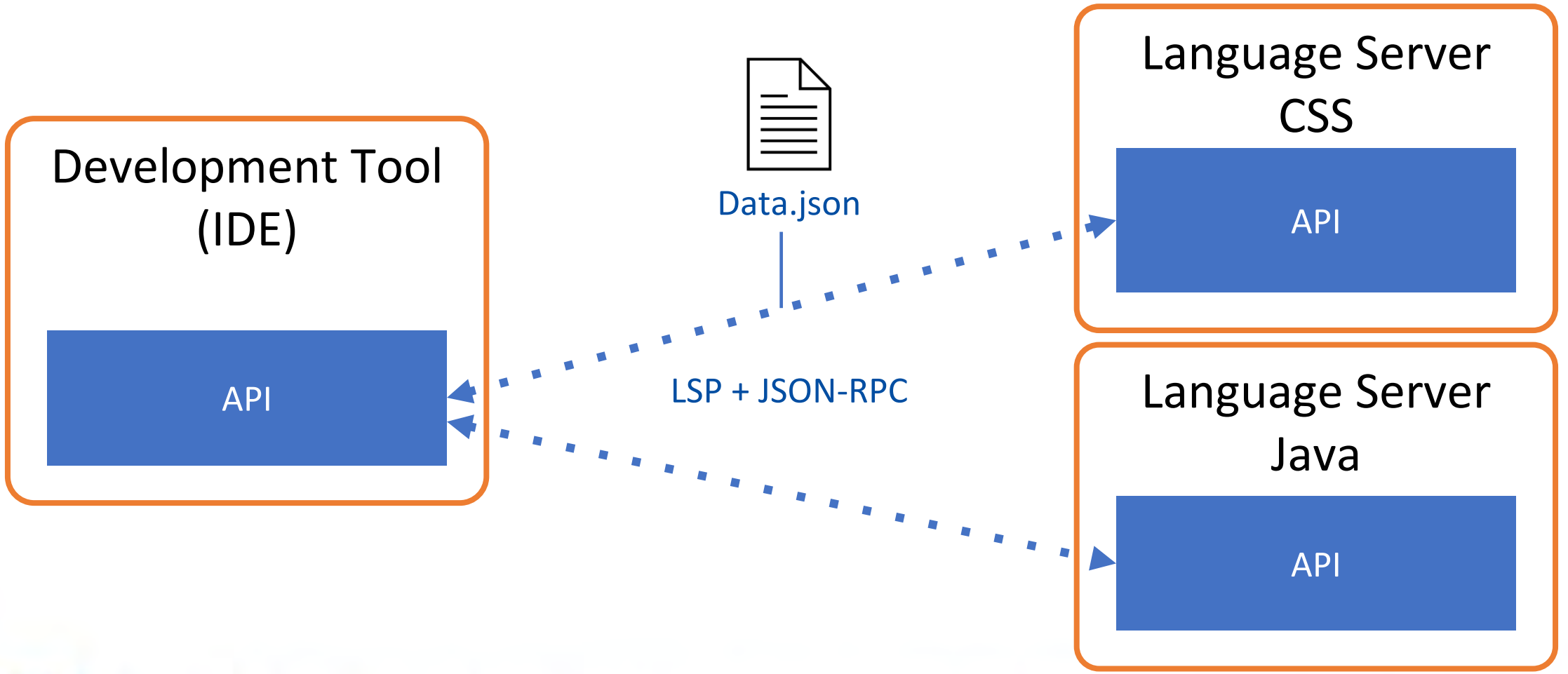


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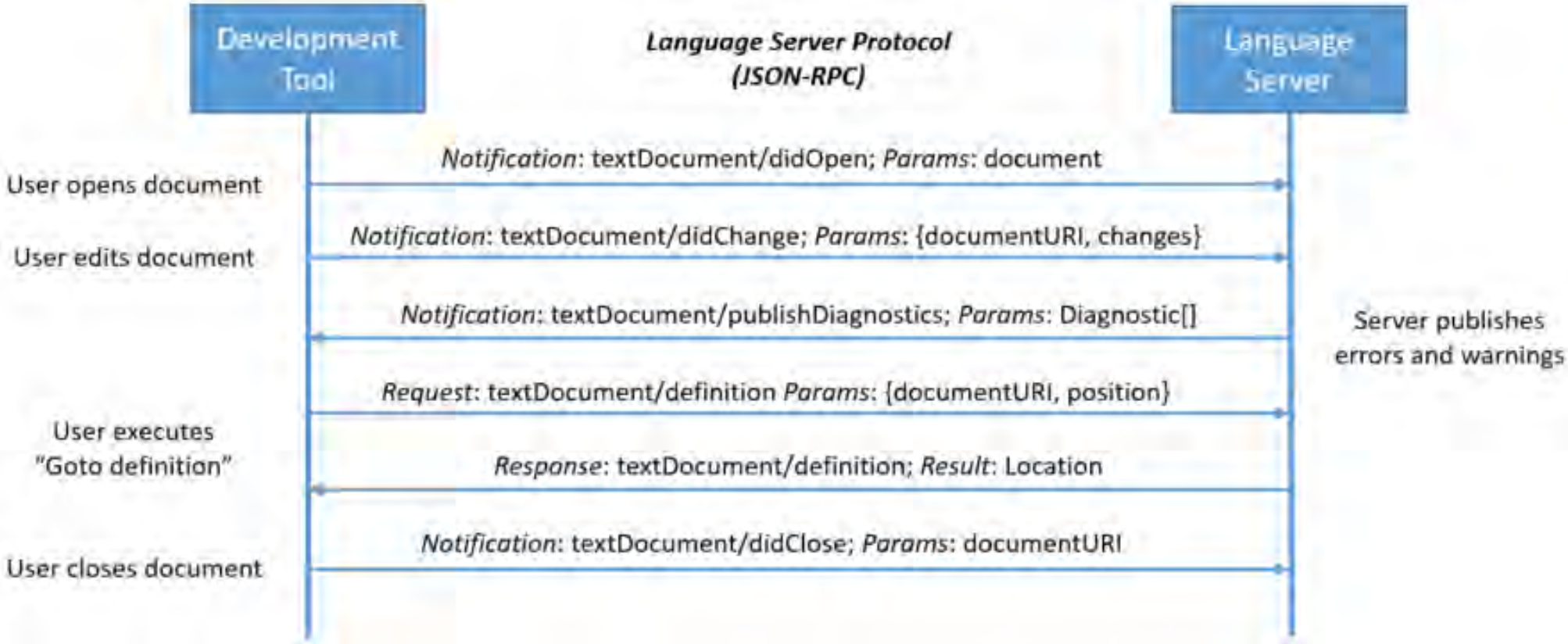


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# Literature


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- A. Wiles et.al., Achieving Technical Interoperability – the ETSI Approach, 2008, https://www.etsi.org/images/files/ETSIWhitePapers/IOP%20whitepaper%20Edition%203%20final.pdf
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# Thank you for attention!

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